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OLIVE FRUIT INFESTATION BY *BACTROCERA OLEAE* GMELIN AND ROSSI, 1788 (DIPTERA- TEPHRITIDAE) IN THREE BIOTOPES OF GRANDE KABYLIE (ALGERIA)

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ABSTRACT

Our work brings on estimate of olives infestations by *Bactrocera oleae* which is fearsome scourge the most devastating on olive tree, in three different biotopes of region of Tizi-Ouzou in Grande Kabylie. The three olive groves consist of the same variety of olive which is The Chemlal. During year 2008, first attacks of olive fly have begun from 4th August in olive grove of Boudjima with 3.2% and only 15 days after in the others both stations which are kept away from the Mediterranean sea with rate of 2% and 6.4% respectfully to Ikhelouiyen and Maatkas. These rates do not cease to increase in the three olive groves until to reach maximum towards December month. They reach 70.4% in Boudjima, 68% in Ikhelouiyen and 62.4% in Maatkas. Variance analysis showed attack difference of olives by olive fly in the three biotopes. According to cardinal directions and the centre of the tree, attacks differ from a direction to another one at level of the tree olive groves and this for each month from August. At harvest moment which is December, East direction is the most infested in two stations, with respective rates of 76.8% for Ikhelouiyen and 76.4% for Maatkas. It is noted 78% in the Centre of Boudjima, in the same month.

KEYWORDS: Olive Groves – *Batrocera oleae* - Infestation Rates – Cardinal Direction – Chemlal – Tizi-Ouzou

INTRODUCTION

In spite of its large rusticity, olive tree is sensitive to attacks of several devastating. Yes it shelters enough rich and diversified fauna with particularly notable phytophagous with damages on economic standpoint requesting often interventions to safeguard, production of this tree (Jardac and Ksantini 1996). These insects can attack various plants' organs (Bonnemaison, 1962; Civantos Lopez-villalta, 1999). Among the most dangerous species, we find olive fly, *Bactrocera oleae* which is a dipteran of Tephritidae's family. Its geographic distribution gathers all the Mediterranean zone; Western Asia and Eastern Africa and so South-East. That is to say, in all olive production areas in the world (Ramos and al. 1982; Economopoulos 2002; Van Steenwyk and al, 2002). Damages which can be caused by larvae *Bactrocera oleae* reach 30% of production in Mediterranean zones, especially in Greece and Italia (Economopoulos and al. 1982; Michelakis 1990). On olives intended for conservation, bites constitute a default making fruit unsuitable for marketing. To the ones destined to oil mills if they are early bitten in the season, they fall before to be harvested. For attacked fruit afterwards, they stay on the tree but tunnels caused by larvae affect yield and quality of oil (Delerio, 1979; Arambourg, 1986). In the world, several studies were performed on insect's bio-ecology. There is a reason to mention those realized in Greece by Laudeho and al (1975), Liaropoulos (1978) and Canard and al (1979). In Algeria no much works had been performed on this devastating insect. In the East of the country, we can point out works of Gaouar and Debouzie (1991) and Gaouar (1996) performed in olive groves at Tlemcen, where orchards are essentially constituted of variety of table olive production. Present study is performed in centre of the country and more

exactly at Tizi-Ouzou in Grande Kabylie. This region is well known by olive oil production of good quality. In this mountainous zone, bio-ecology of insect is not much known. For these reasons we judged important to follow infestations evolutions caused by this insect in the time, in different biotopes and to try identifying some biotical and abiotical factors which can play role in population's dynamics of this devastating.

MATERIALS AND METHODS

Presentation of Study Regions

Three regions are selected for this study: Boudjima Ikhelouiyen and Maatkas which form a part of Tizi-Ouzou wilaya situated at 100 km of Algiers East. These regions are ecologically different according to their altitude, distance of the sea, ground nature and vegetation. Region of Boudjima is situated as she crow flies at 11 km from Mediterranean Sea and at 300m altitude (36° 48' 50''N, 4° 09' 32'' E.). Region of Ikhelouiyen is at altitude of 560 m (36° 45' 37'' N, 4° 08' 11'' E.) and moves away of 20 km from Mediterranean Sea. Maatkas region is situated at 40 km from the Mediterranean Sea and to South-West of Boudjima and of Ikhelouiyen and at altitude of 700 m (36° 36' 44'' N, 3° 59' 16'' E.). The olive growing orchard of Tizi Ouzou is essentially composed of Chemlal variety well known for its oil richness of excellent quality. Trees are coming from grafting on oleaster and aged of 50 years old in average. All olive groves of this region receive no treatment against those devastating

Study of Fruit Infestation

With the aim to follow infestation caused by *Bactrocera oleae*, it is proceeded by weekly sampling of olives from the first appearance of adult trapped in Mac Phall's traps set in olive groves until the harvest moment. Olive's samples are harvested from 5 trees taken at random at level of orchard at the rate of 50 olives by tree which is 10 olives by cardinal direction and 10 at the centre of the tree. Total number collected is in order of 250 by orchard.

The laboratory work consists in counting bitten olives and those ones which present exit holes' larvae and adults. Analysis is made according to cardinal directions of the tree to deduce possible difference of attack in accordance of expositions. The fact to find tracks of bites does not signify there is automatically egg emission. For this, we have proceeded to dissection of some olives to know the date of egg deposit.

RESULTS AND DISCUSSIONS

Relatives Results to Infestation Rate of Olives by *Bactrocera oleae* during Year 2008 at Level of the Tree Olive Groves

The first infestations are observed from 4th of August in olive grove of Boudjima with rate not exceeding 3.2%. On the other hand in both other olive groves, infestations are noted only 15 days after, which is on 18th of August with respective rate of 2% and 6.4% (fig 1 table 1). At level of the three olive groves, rates do not exceed 11% at the end of August. Gaouar (1996), notes these infestations in region of Tlemcen are of weak intensity during July and August. This can be explained by high temperatures recorded during this month in the three olive groves. With that in mind, average maximum temperatures are 35.2°c in Boudjima, 33.4°c in Ikhelouiyen and 32.4° in Maatkas. According to Fletcher and al. (1987) in summer, olive fly's fertility is mainly influenced by higher temperature and availability of receptive fruit.

Towards the end of September, rates reach 39.6% at Boudjima and 23.6% at Ikhelouiyen and 35.6% at Maatkas. At this stage, olives are more receptive and temperatures are mild. Infestations are more important in Boudjima situated at 11km only from the sea, where the two others olive groves are far away. That is noticed in Greece by Liaropoulos (1978). This author writes that at Scala situated in Island of Aguistri, appearance of notable damages occurring during the first days of September, even though it would wait the beginning of October to see the rate exceeding 5% at Ktima which a zone situated in internal plains. At the end of October, it is recorded a rate of 61.2% at Boudjima, 51.2% at Ikhelouiyen and Maatkas 57.2%. Average temperatures recorded during this period vary between 17°c and 20.2°c. Temperatures are therefore more gentle which influenced on flight activity of adults' olive fly Arambourg (1986), writes that flight activity increases from 14°c. In October, olives begin to turn towards red which attract females of *Bactrocera oleae* for eggs laying. In the same sense Neuenschwahder and al. (1986), mention that among fruit of different colours, those ones which are green-yellow or red are preferred to green or black fruit. Percentages of attacked olives do not cease to increase in the three stations, during November and December. They exceed 70% at harvest moment at Boudjima and rates of 68% and 66.4% are respectfully noted at Ikhelouiyen and Maatkas. These rates are very important and oils which coming from would be affected according to Pastre (1991) and El antar and al, (2003). Mraicha and Ksantini (2011), note that infestation do not exceed economic threshold of 10%, when these varieties are cultivated with table varieties. It seems that in olive trees plots having several varieties, fly adults, head for big fruit such as table varieties (Neuenschwander, et al, 1986). Variance analysis of test GML performed to two criteria shows that compared difference between infestation rates is highly significant(p=o,ooo) (Table 2). And this is right for study regions factor and for the time factor. That confirms results obtained at Tlemcen by Guaouar et Debouzie (1991). Yes these authors note that infestations vary from region to another, from year to another and even from date to another.

Variation of Olive Infestations by *Bactrocera oleae* according to Cardinal Directions

At Boudjima, during August, average rate of olive attack by *Bactrocera oleae*, the most important is recorded at the centre of the trees with 36% (Table 3-Figure 2). According to Arambourg (1986), adults of *B. Oleae* frequent the freshest parts of the trees. At Ikhelouiyen and Maatkas, average rates are weak in all directions and do not exceed 2.5% (Table 4-Figure 3) and 5.5% (Table 5- Figure 4), this is explained by the fact that infestations in both olive groves have been appeared only towards end of this month. During September, at Boudjima, average rates recorded reach 32% in the South. They reach 21% in the south at Ikhelouiyen and 31.5% in the East in olive grove of Maatkas during the same month. On October, percentages the most important are noted in the centre of Boudjima with 51%. On the East, at Ikhelouiyen with 50.5% and at the same East direction for Maatkas with 54%. During November it is noted 70% in the South for Boudjima, 67.5% and 75% in the East respectful for Ikhelouiyen and Maatkas East direction is the most infested during December in two study stations with respective average rates of 76.8% for Ikhelouiyen and 76.4% for Maatkas. During the same month, it is noted 78% in the Centre of Boudjima. Liaropoulos (1978), at Akrefnion, in Geece mentions that attack rates the most important are noted at the end of November for the whole of tree directions. This author notes 86.4% in the centre ot the tree, 78.8% in the North, 86.5% in the South, 86.3% in the East and 81.1% in the West.

CONCLUSIONS

First infestations are observed during August with weak rates do not exceeding 6% at level of different olive groves. When temperatures are more gentle, rates increase and may reach 39.6% at Boudjima and 23.6% at Ikhelouiyen and 35.6% at Maatkas in September. Percentages of attacked olives increase in the three stations during November and

December. Acoording to cardinal directions, in December, East direction is the most infested for Ikhelouiyen and Maatkas. During the same month it is noted 78% in the Centre for Boudjima.

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APPENDICES

Table 1: Rates of Infestation by *Bactrocera oleae* in the Three Study Areas

Regions / Date	Rates of Infestation (%)		
	Boudjima	Ikhelouiyen	Maatkas
04/08/2008	3,2	0	0
11/08/2008	4,4	0	0
18/08/2008	5,2	2	6,4
25/08/2008	10,8	5,6	11,2
04/09/2008	17,6	10	17,2
11/09/2008	21,6	10,8	23,6
17/09/2008	39,6	22	28,4
25/09/2008	39,6	23,6	35,6
01/10/2008	39,6	40,4	42,4
09/10/2008	41,2	41,6	40,8
16/10/2008	54	43,6	48,4
23/10/2008	61,2	51,2	57,2
02/11/2008	60	53,2	62
10/11/2008	60,8	61,2	66
12/11/2008	64,8	62,8	68,2
20/11/2008	67,6	67,2	70
01/12/2008	68,8	68	67,2
08/12/2008	72,4	70,4	68
16/12/2008	69,2	70,4	69,2
22/12/2008	70	67,6	70,4
29/12/2008	70,4	68	66,4

Table 2: Analysis of Variance used for Comparative Rates of Infestations in Different Regions and Periods

Source	Sum-of-Squars	df	Mean-Squar	F-Ratio	p
Regions	266.667	2	133.333	12.480	0.000
Periods	39427.714	20	1971.386	184.529	0.000
Error	427.333	40	10.683		

Table 3: Olive Infestations by *Bactrocera Oleae* According to Cardinal Directions in Boudjima

Cardinal directions / Months	Percentage of Infestation Drupes				
	Center	North	South	East	West
August	36	26	34	12	10
September	29,5	28	32	28	30,5
October	51	47,5	49,5	49	48
November	64,5	60	70	59,5	62,5
December	78	74	66,4	66,8	65,6

Table 4: Olive Infestations by *Bactrocera oleae* According to Cardinal Directions in Ikhelouiyen

Cardinal Directions / Months	Percentage of Infestation Drupes				
	Center	North	South	East	West
August	1	2	2,5	2	2
September	15	14,5	21	16,5	16
October	40	40,5	46,5	50,5	43,5
November	61	58	58	67,5	61
December	63,2	66,4	71,6	76,8	66,4

Table 5: Olive Infestations by *Bactrocera oleae* According to Cardinal Directions in Maatkas

Cardinal Directions / Months	Percentage of Infestation Drupes				
	Center	North	South	East	West
August	3	4	5	5,5	4,5
September	25,5	22,5	28	31,5	23,5
October	46,5	47	50,5	54	43
November	58	72,5	64	75	64
December	61,6	66	66	76,4	71,6

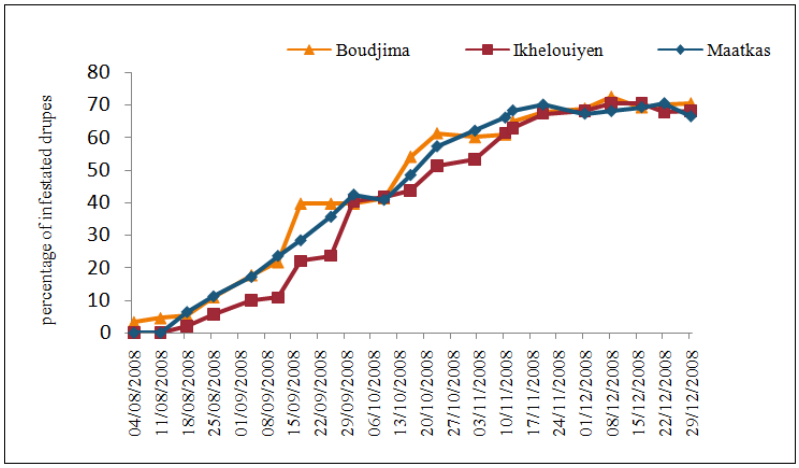

Figure 1: Infestation Levels in Three Olive Groves in 2008

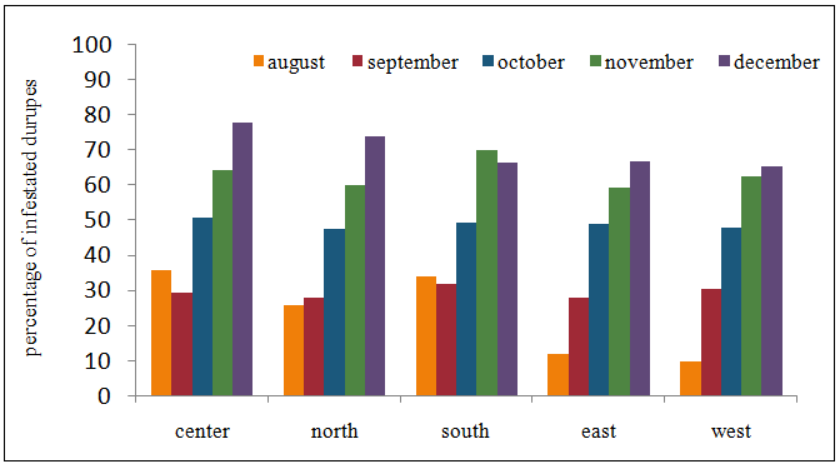

Figure 2: Rates of Infestations According to Cardinal Directions in Boudjim a in 2008

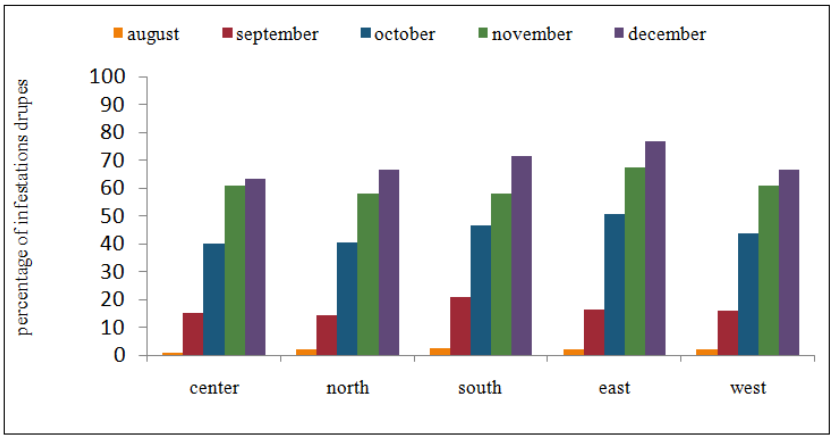

Figure 3: Rates of Infestations According to Cardinal Directions in Ikhelouiyen in 2008

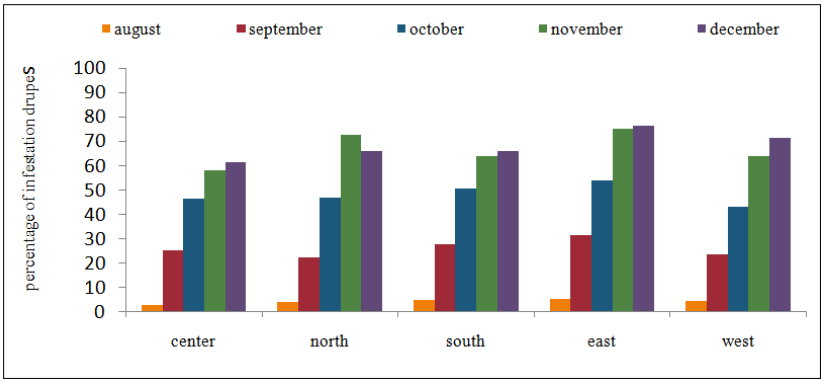

Figure 4: Rates of Infestations According to Cardinal Directions in Maatkas in 2008